

FIG. 2  
(PRIOR ART)

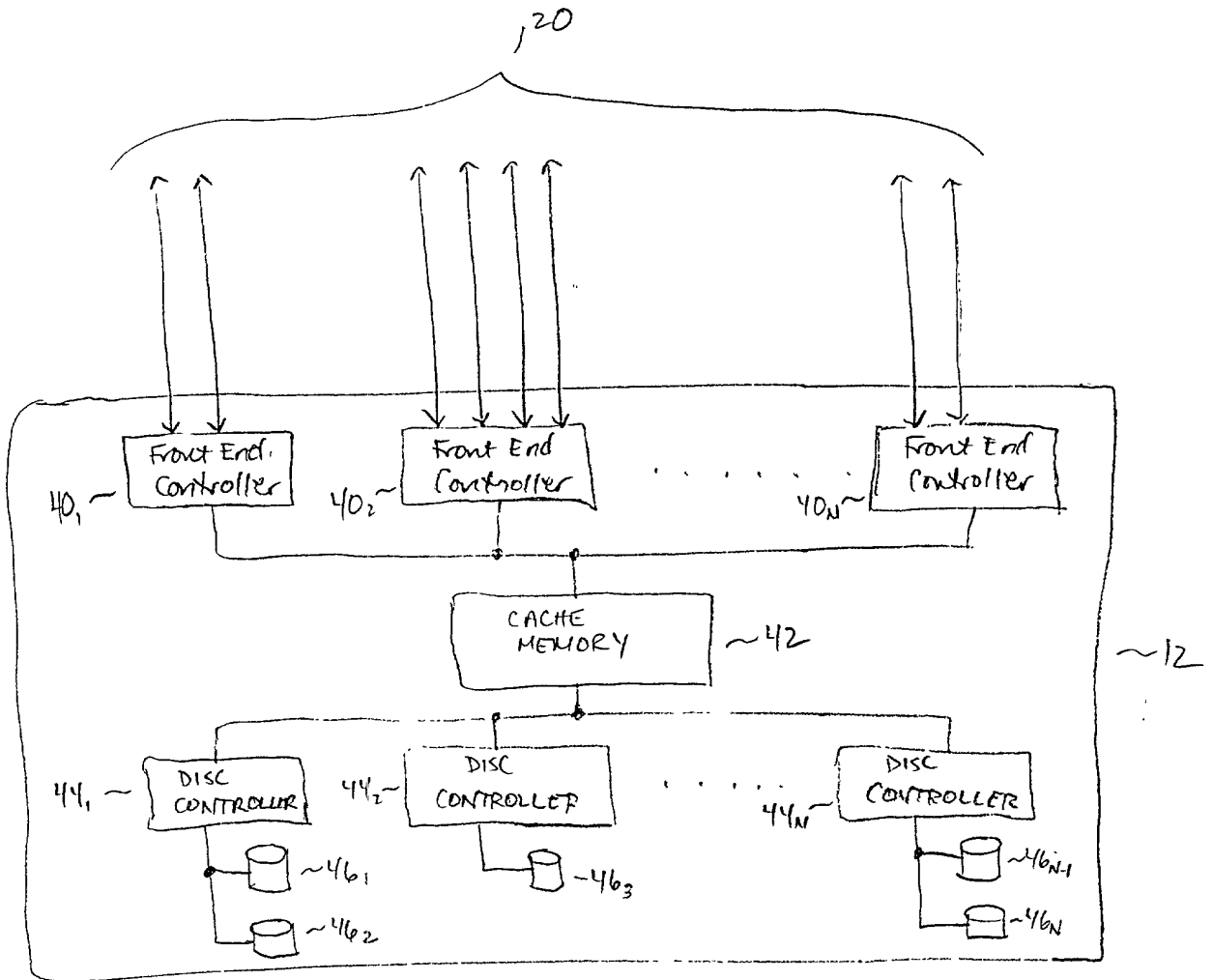


FIG 3  
(PRIOR ART)

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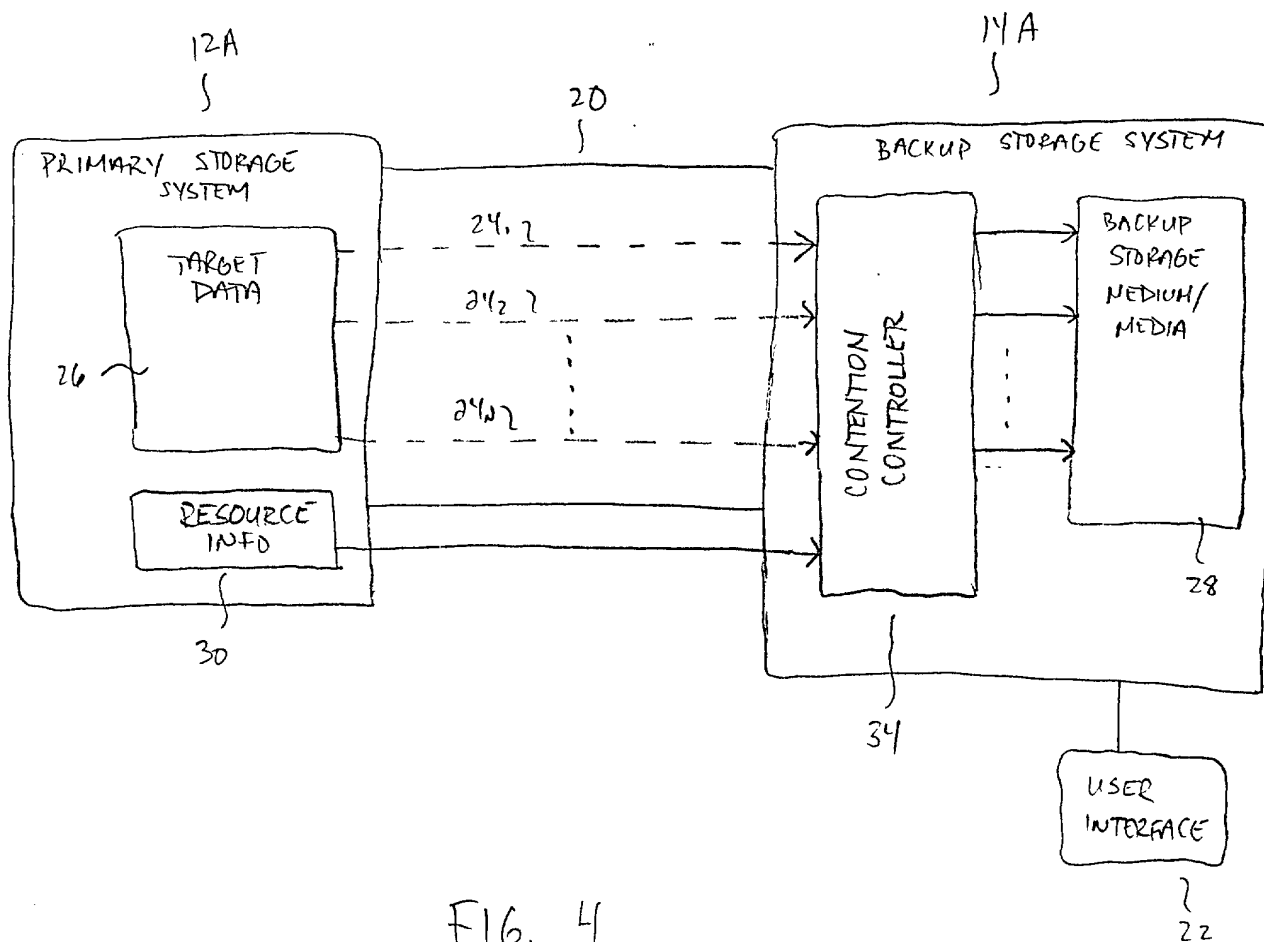
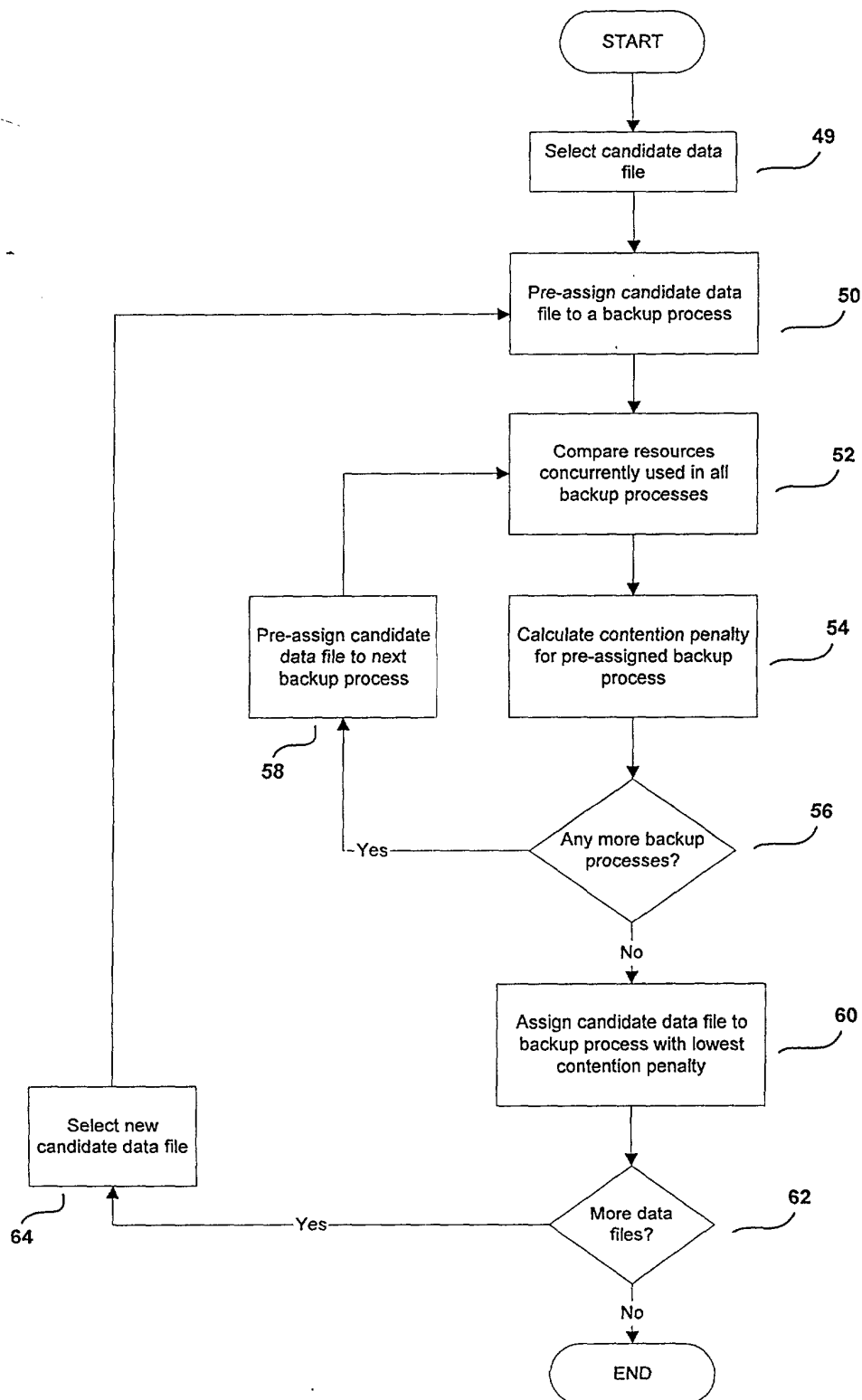


FIG. 4



**FIG. 5**

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graph TD
    Start([Start]) --> 70[Specify target data files  $F_{1,2,3,\dots}$  and number  $N$  of backup processes (BP) to backup target data,  $BP = 1, 2, \dots, N$ ]
    70 --> 72[List target data files from largest to smallest,  $F_{largest}, \dots, F_{smallest}$ ]
    72 --> 74[For each segment  $S_1 - S_M$  of each file  $F$ , obtain corresponding resource information (maintain table of Fig. 8 for each file  $F$ )]
    74 --> 76[Set file pointer  $F = F_{largest}$ ]
    76 --> 78[Pre-assign file  $F$  to one backup process,  $BP=1$ ]
    122([From link 108 in Fig. 6B]) --> 78
    78 --> 80[Set time pointer to elapsed time of backup process  $BP$ ,  $t_p = t_{BP}$  (See Fig. 7)]
    80 --> 82[For a first segment  $S_1$  of file  $F$  (for first row of Fig. 8), compare resources  $(R1, R2, R3, \dots)$  used to access  $S_1$  with resources used in all other backup processes (see table of Fig. 9 for each other backup process) during the time interval  $D_1$  for the segment  $S_1$ ; for each resource, add the total amount of time the same resource is used in other backup processes during the time interval  $D_1$  to generate a segment penalty for each resource]
    82 --> 84[Repeat step 82 for each segment  $S_2 - S_M$  of file  $F$ , and add all segment penalties for each resource to obtain a total file contention penalty for each resource from pre-assigning file  $F$  to process  $BP$  (one row of Fig. 10)]
    84 --> 86{Any more backup processes?  $(BP < N?)$ }
    86 -- Yes --> 88[BP = BP + 1]
    88 --> 82
    86 -- No --> 90[Table in Fig. 10 Complete For File  $F$ ]
    90 --> 91A([Go to link 91B in Fig. 6B])

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74

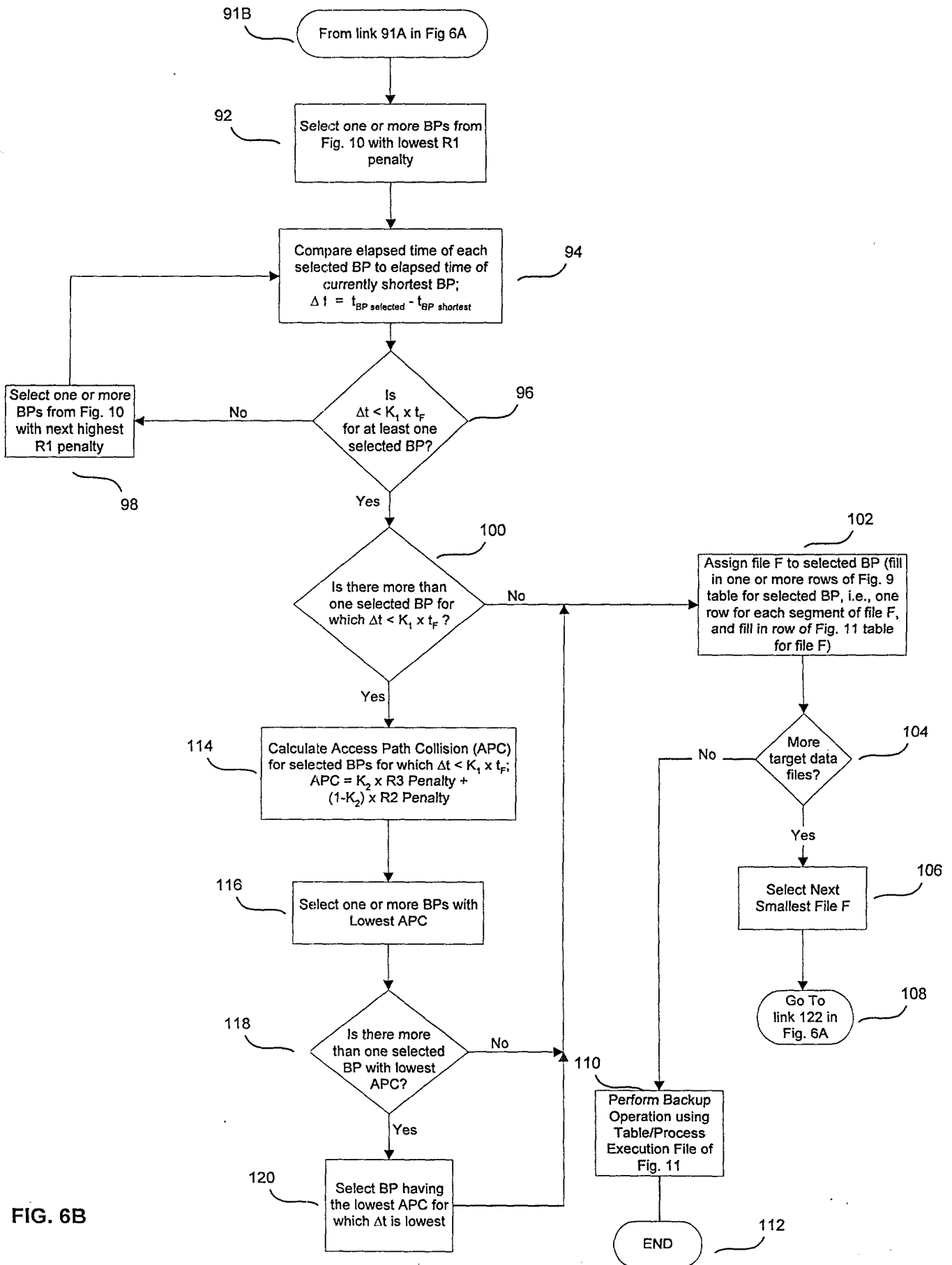


FIG. 6B

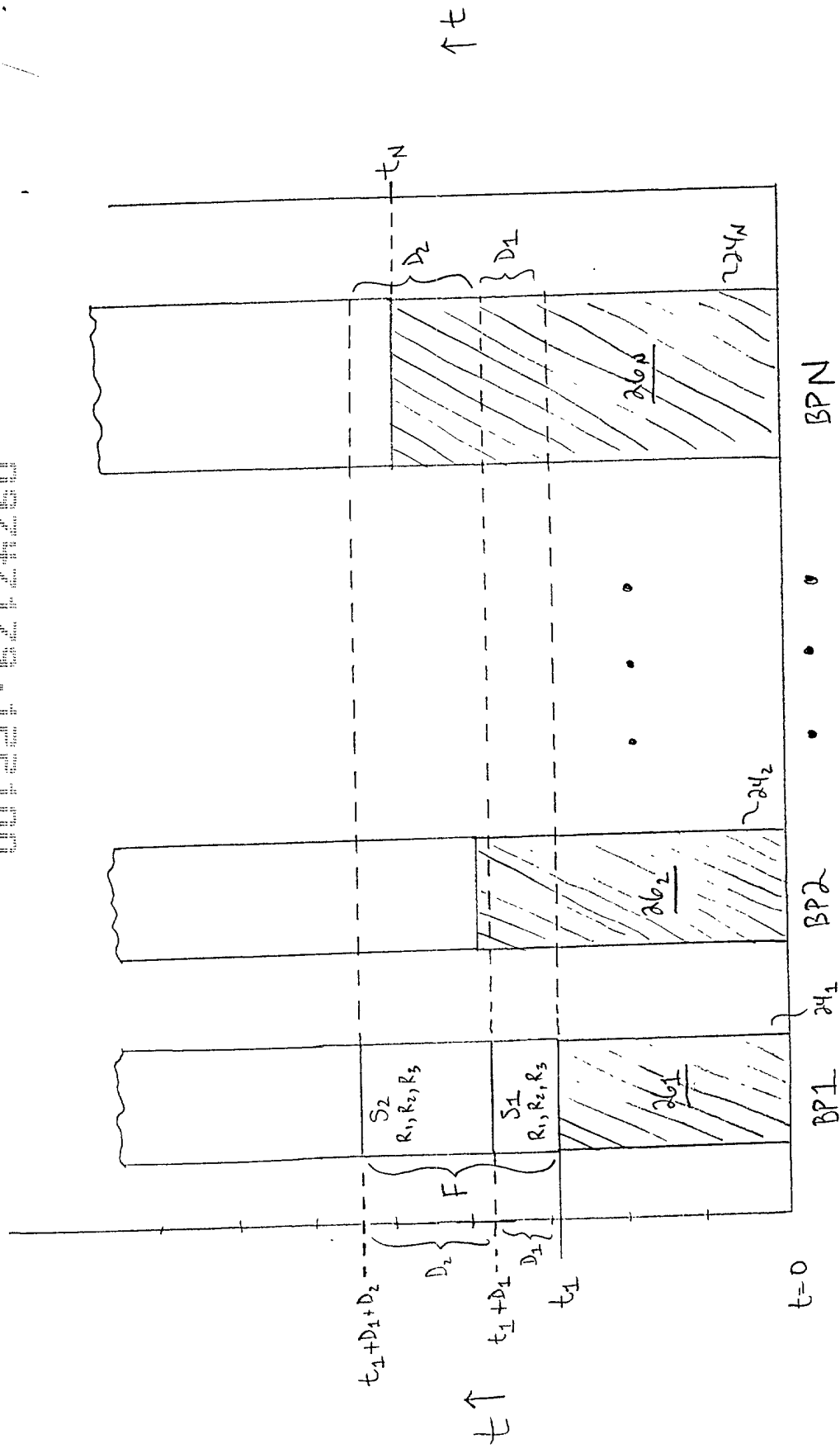


FIG. 7



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Segment/ Duration	Spindle (R1) ID	DISC CONTROLLER (R2) ID	FRONT END CONTROLLER (R3) ID
S1/10ms	2	3	1
S2/20ms	6	2	2
S3/D3			
S4/D4			
⋮			
S <sub>M</sub> /D <sub>M</sub>			

FIG. 8

TIME 't' (ms)	SPINDLE ID (R1)	DISC CONTROLLER ID (R2)	FRONT END ID (R3)
0:			
D <sub>1</sub>			
D <sub>1</sub> + D <sub>2</sub>			
D <sub>1</sub> + D <sub>2</sub> + D <sub>3</sub>			
'			
'			
'			
... D <sub>M-2</sub> + D <sub>M-1</sub> + D <sub>M</sub>			

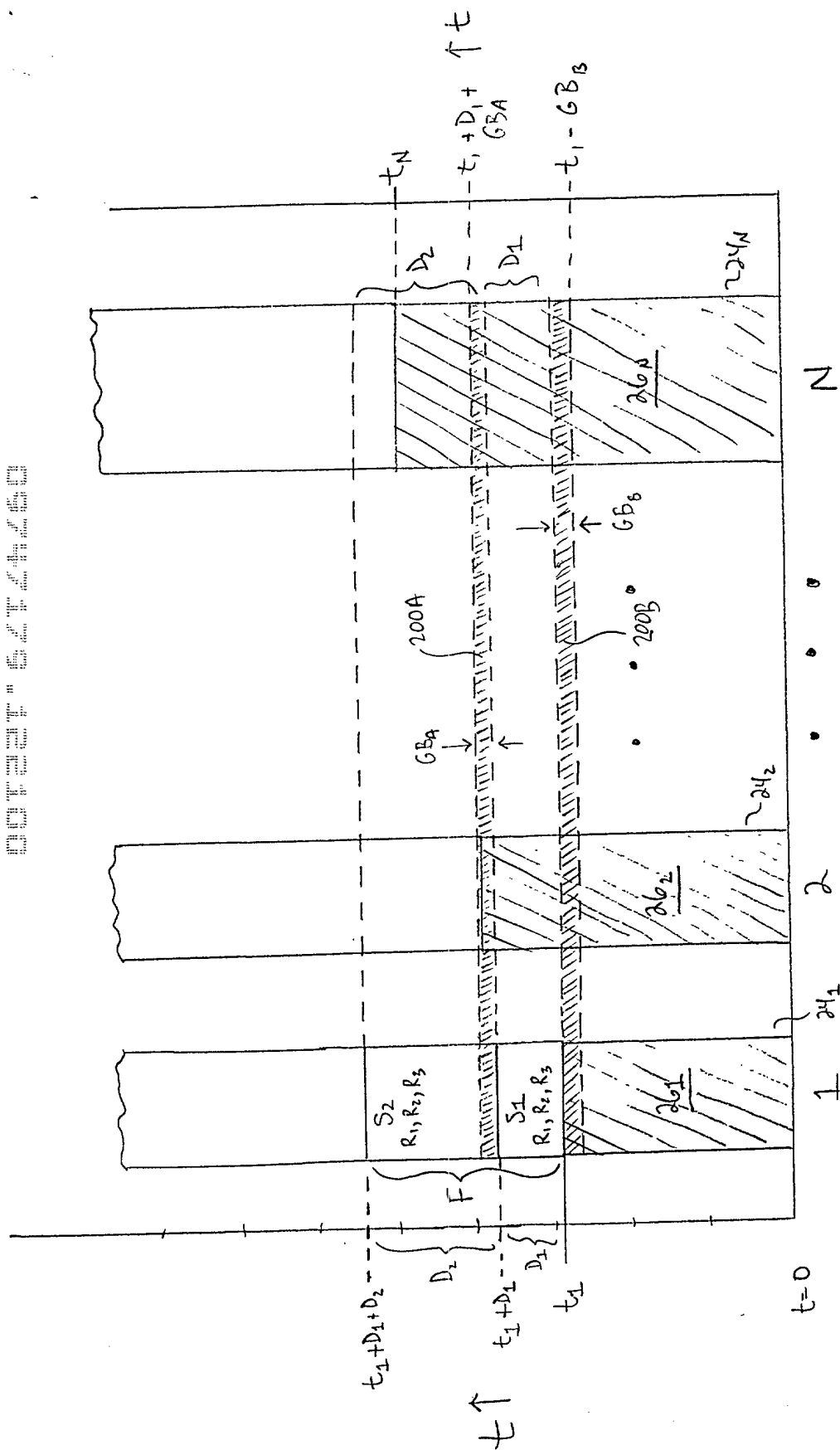
FIG. 9

BACKUP PROCESS (BP)	TOTAL SPINDLE (R1) PENALTY	TOTAL DA (R2) PENALTY	TOTAL FRONT END (R3) PENALTY
1			
2			
3			
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
N			

FIG. 10

FILE NAME	BACKUP PROCESS	ORDER IN PROCESS
$F_{largest}$		
<div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> </div>	<div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> </div>	<div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> </div>
$F_{smallest}$		

;



BACKUP PROCESSES (BP)

FIG. 12